

State of California  
AIR RESOURCES BOARD

DRAFT PROPOSAL SUMMARY

PROPOSED REGULATIONS FOR  
GASOLINE SPARK-IGNITION MARINE ENGINES

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## TABLE OF CONTENTS

I.	Introduction .....	-1-
A.	Background .....	-1-
B.	Federal Emission Standards .....	-2-
II.	Staff Proposal .....	-3-
A.	Emission Standards .....	-4-
III.	Regulatory Provisions .....	-6-
A.	Emission Control Labels and Engine Identification Number .....	-6-
B.	Consumer/Environmental Label Requirements .....	-6-
C.	Emission Performance Consumer Notification .....	-7-
D.	In-Use Compliance Testing and Recall .....	-7-
E.	Defects Warranty Requirements and Emission Control Warranty Statement .....	-8-
F.	Compliance and Production-Line Testing .....	-9-
IV.	Summary .....	-9-

## DRAFT PROPOSAL SUMMARY

### PROPOSED REGULATIONS FOR GASOLINE SPARK-IGNITION MARINE ENGINES

#### **I. Introduction**

The purpose of this report is to provide an overview of the proposed Gasoline Spark-Ignition (SI) Marine Engine Regulations. Staff is proposing exhaust emission standards for gasoline SI marine engines for consideration by the Board in December 1998. The proposed regulations for outboard and personal watercraft will include provisions for certification, environmental and consumer labeling, in-use testing and recall, defects warranty and compliance and production line testing.

Although dramatic improvements have been made to California's air quality over the last 40 years, in order to meet health-based air quality standards under the schedule outlined in the State Implementation Plan (SIP), more progress is needed, especially in the near term. California has six regions which have not attained these air quality standards. Specifically, they exceed the federal one-hour standard for ozone. These regions include the South Coast Air Basin, the Sacramento Metropolitan area, the San Diego Air Basin, the San Joaquin Valley Air Basin, the South East Desert Air Basin and Ventura County. More areas of California are likely to be designated as non-attainment under the new federal eight-hour standards.

Mobile sources, consisting of passenger cars, trucks, heavy-duty vehicles, off-road vehicles and equipment, and marine engines, account for about 60 percent of ozone precursor emissions statewide. Control of these mobile sources is vital to attainment of air quality standards.

#### **A. Background**

**Applicability.** The proposed exhaust emission standards are applicable to outboard marine and personal watercraft engines, including jet boats.

**Emissions Impact.** Emissions of hydrocarbons (HC) and oxides of nitrogen (NO<sub>x</sub>) from outboard and personal watercraft in 1997 totaled 312 tons per day. This compares to 1,374 tons per day statewide for passenger cars. While reductions from gasoline SI marine engines are not included in California's SIP as a planned measure for meeting attainment goals, the impact of outboard and personal watercraft engines on the state's total emissions inventory makes control of this category of emissions necessary. Table 1 lists the relative contribution of outboard and personal watercraft exhaust emissions in California in tons per day. As a comparison to other

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sources, the exhaust emissions from two hours of personal watercraft operation is equivalent to the emissions from a 1998 passenger car operated over 100,000 miles.

This regulation is also driven in part by concerns over discharge of unburned fuel into lakes, reservoirs and waterways. According to studies cited in the U.S. EPA gasoline SI marine engine rulemaking, conventional two-stroke engines discharge 25 to 30 percent of fuel unburned into the water. Recent attention focused on detection of methyl-tertiary-butyl-ether (MTBE) in drinking water supplies has caused a number of water quality agencies to consider restriction of two-stroke watercraft on particular waterways. Other gasoline constituents emitted into the water, including carcinogenic benzene and toluene, have also been of significant concern.

**Table 1**  
**1997 Statewide Recreational Marine Engine Emissions**  
(tons per day)

Equipment Type	Population	HC	NO <sub>x</sub>	HC+NO <sub>x</sub>	CO	PM
Personal Watercraft	161,898	246	2	248	414	13
Outboards	346,372	63	1	64	120	4
<b>Total</b>	<b>508,270</b>	<b>309</b>	<b>3</b>	<b>312</b>	<b>534</b>	<b>17</b>

<note: based on 6/4/98 inventory numbers>

## **B. Federal Emission Standards**

In 1996, the U.S. Environmental Protection Agency (U.S. EPA) adopted exhaust emission standards for gasoline SI marine engines (40 CFR Parts 89, 90, and 91, Air Pollution Control; Gasoline Spark-Ignition Marine Engines; New Nonroad Compression-Ignition and Spark Ignition Engines, Exemptions; Rule). The goal of this rule is to reduce emissions of HC from outboard and personal watercraft engines by 75 percent from baseline levels by 2025. Emission standards for outboard engines took effect in 1998 and the first standards for PWC will take effect in 1999. The U.S. EPA exhaust emission standards are phased in from the initial implementation date through 2006 and are calculated using an equation that is dependent on sales weighted engine power output. Figure 1, below, shows the 2006 standards in grams per kilowatt-hour for power output of 5 to 300 kilowatts assuming models in any given engine family have the same power output. Given the significant impact of emissions from gasoline SI marine engines have on California's air quality, staff is proposing exhaust emission standards that will reduce emissions from this category by 50 percent beyond the federal program by 2010.

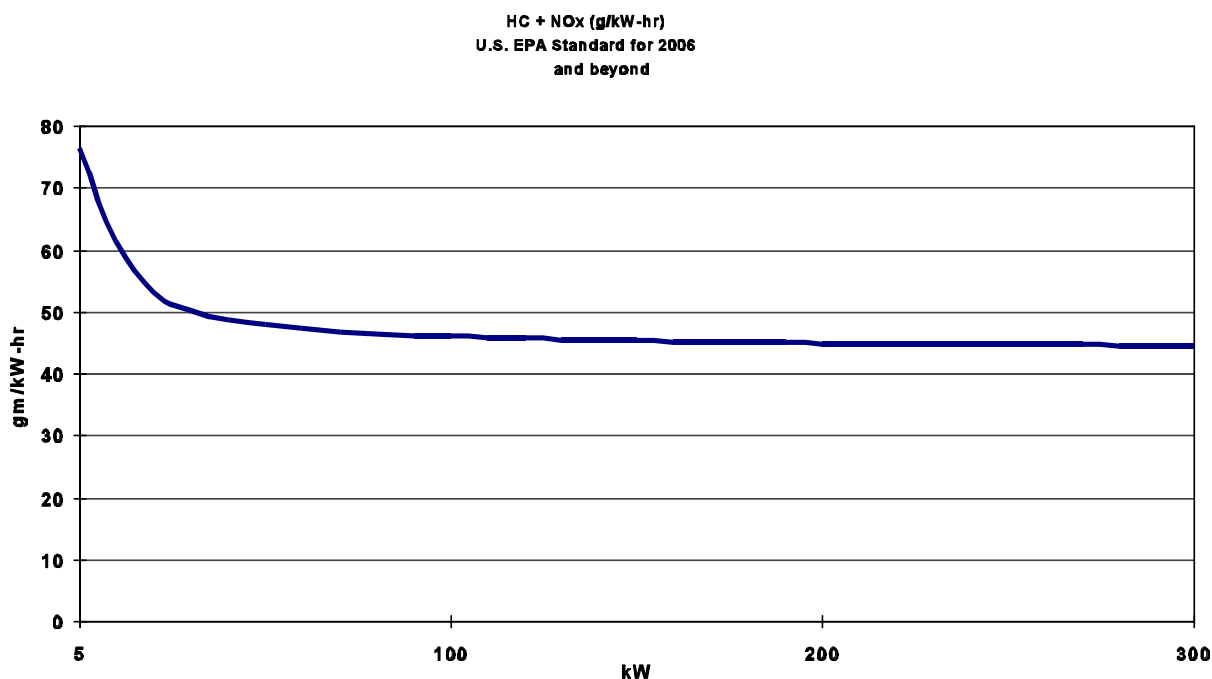
## II. Staff Proposal

The proposed regulation applies to outboard engines and personal watercraft. Outboard engines are defined as integrated engine and drive units mounted external to the hulls of watercraft. Personal watercraft engines are defined as watercraft that are not outboards, inboards, or sterndrive engines. This encompasses the watercraft we typically think of as personal watercraft (Jet Skis, Wave Runners, etc.) and jet boats (the newer class of inboard style watercraft using two-stroke jet propulsion.) These definitions are consistent with the U.S. EPA gasoline spark-ignition marine engine rule.

The proposal does not apply to inboard or sterndrive engines, although staff may address exhaust emissions from inboard and sterndrive engines in a future rulemaking. This proposal also does not address evaporative or refueling emissions which are believed to be significant. Staff may choose to address these emission sources as part of this or a future rulemaking.

The initial implementation date of the proposed regulation is model year 2001. Over the following six years, through 2007, the exhaust emission standards are lowered twice, providing for a phased in approach to meeting the final goal of establishing emission standards which will significantly reduce emissions. Figure 1, below, shows U.S. EPA 2006 standards across power ratings for gasoline SI marine engines.

**FIGURE 1**



## A. Emission Standards

**Proposal.** The proposed regulation establishes the corporate average exhaust emission standards in grams per kilowatt-hour (g/kW-hr) as listed below in Table 2. The numbers listed in parentheses are the upper limit to which manufacturers may certify engine families as part of the corporate averaging program.

The corporate average emission standards decrease through the phase-in years to provide for a steady improvement in manufacturers' product lines. With the averaging program, by having a lower interim average emission standard, manufacturers will need to convert more of their product line to cleaner technologies throughout the implementation period of the regulation.

**TABLE 2**  
**Corporate Average Exhaust Emission Standards**  
**HC+NO<sub>x</sub>**  
(g/kW-hr)

Category	Model Year 2001	Model Year 2004	Model Year 2007
Outboards less than or equal to 75 kW	20 (40) <sup>1</sup>	17 (40) <sup>1</sup>	13 (27) <sup>1</sup>
Outboards greater than 75 kW	40 (134) <sup>1</sup>	27 (80) <sup>1</sup>	13 (40) <sup>1</sup>
Personal Watercraft	40 (134) <sup>1</sup>	27 (80) <sup>1</sup>	13 (40) <sup>1</sup>

<sup>1</sup> For each engine family, the manufacturer designated exhaust emission standard for corporate averaging must not exceed the value in parentheses.

Under a corporate averaging emission standard program, manufacturers certify engine families to a "manufacturer designated exhaust emission standard." The designated exhaust emission standard is an in-use standard, meaning the manufacturer certifies that the engine's emissions will not exceed the designated standard at any time during its useful life. The designated standard for an engine family may be above or below the corporate average emission standard, but it may not exceed the level noted in parentheses (the upper limit of the corporate averaging program) in Table 2, above. And while engine families may be certified above or below the corporate average standard, the manufacturer's product line must, on a sales weighted average, have emissions equal to or below the corporate average emission standard. Table 3 lists the corporate average emission standards in grams per brake horsepower-hour for comparison to other Air Resources Board mobile source regulations.

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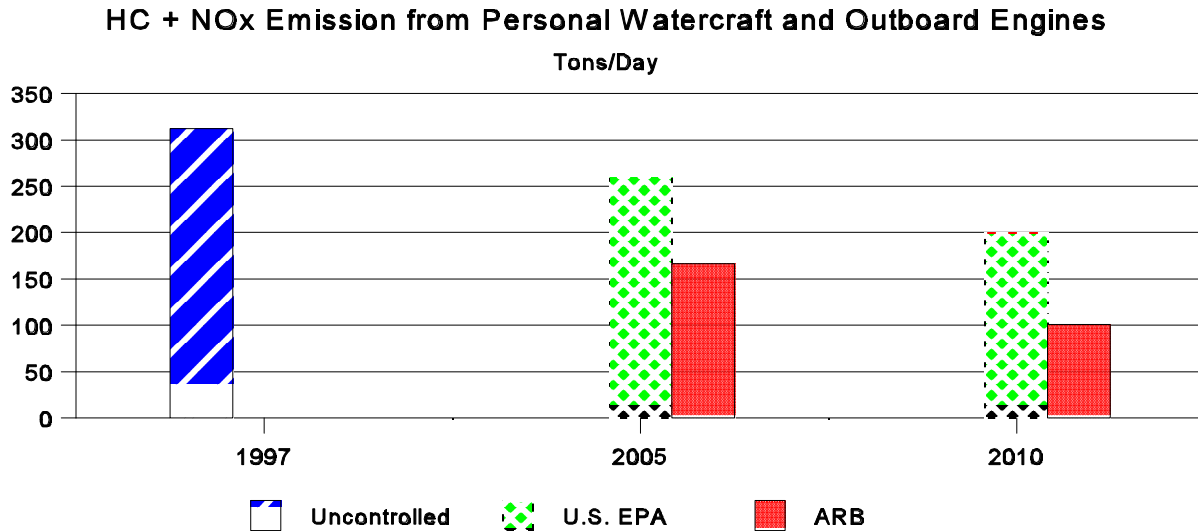
**TABLE 3**  
**Corporate Average Exhaust Emission Standards**  
**HC+NO<sub>x</sub>**  
(g/bhp-hr)

Category	MY 2001	MY 2004	MY 2007
Outboards less than or equal to 100 hp	15 (30) <sup>1</sup>	13 (30) <sup>1</sup>	10 (20) <sup>1</sup>
Outboards greater than 100 hp	30 (100) <sup>1</sup>	20 (60) <sup>1</sup>	10 (30) <sup>1</sup>
Personal Watercraft	30 (100) <sup>1</sup>	20 (60) <sup>1</sup>	10 (30) <sup>1</sup>

<sup>1</sup> For each engine family, the manufacturer designated exhaust emission standard for corporate averaging must not exceed the value in parentheses.

**Intent.** Preliminary analysis of the marine engine emissions inventory shows that the proposed standards will achieve approximately 50 percent greater reductions than the U.S. EPA requirements by 2010, as shown in the figure 2, below.

**FIGURE 2**



**Technical Feasibility.** The standards proposed by staff correspond to levels demonstrated by current clean technologies seen on the market or anticipated on the market in the next year or two. For example, the 2001 standard for outboards less than or equal to 75 kilowatts is set at a level corresponding to the average emission level for current advanced technology

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outboard engines. The 2001 standard for outboards greater than 75 kilowatts is set at a level which corresponds to the U.S. EPA standard for 2006 and at a level which has been demonstrated by direct-injection two-stroke technology. The 2001 standard for personal watercraft is set at the level corresponding to the U.S. EPA standard for 2006 and which has is also achievable through the use of direct-injection two-stroke technology.

### **III. Regulatory Provisions**

In addition to establishing exhaust emission standards, the proposed regulation sets provisions for emission control engine labels, engine identification numbers, consumer and environmental labeling, in-use compliance testing and recall, defects warranty requirements, an emission control warranty statement, compliance and production-line testing, and testing procedures. Following is a description of each of these provisions and their purpose as part of the proposal.

#### **A. Emission Control Engine Labels and Engine Identification Number**

**Proposal.** The emission control engine labeling requirements are consistent with the U.S. EPA program with the addition of information necessary for California. Staff will work with manufacturers to create a standardized engine identification number for outboard engines and personal watercraft. If staff is not successful in standardizing the format of existing numbers used by manufacturers, the regulation is set up to establish a new number for California tracking purposes. The requirements should not require manufacturers to apply an additional label to their engines, unless the original label is obscured.

**Intent.** The emission control label is an enforcement tool which certifies that the engine bearing the label complies with the California emission standards. The engine identification number for outboard engines and personal watercraft are intended to enable tracking through registration by the Department of Motor Vehicles. This tracking is important for inventory assessment purposes, and is critical for operation of in-use testing programs and for enforcement of in-use testing, warranty and recall programs. As discussed below, warranty and recall programs are important to ensuring emission performance throughout the useful life of the engine.

#### **B. Consumer/Environmental Label Requirements**

**Proposal.** The consumer or environmental label program is geared toward support of water quality control programs. The label is required to be a standard, permanent graphical label, easily recognizable by waterway enforcement personnel. This program will require manufacturers to affix a label established by this regulation to watercraft which meet or are certified to standards lower than the corporate average emission standard. Still under development at this time are the exact graphic to be used on the label, and the size and position of the label. Staff is also exploring

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with water quality control agencies the possible use of a tiered label program indicating the relative cleanliness of engines in comparison with the applicable standards.

**Intent.** Water agencies are under increasing pressure to restrict activity of watercraft adversely affected by unburned fuel discharge from watercraft. ARB's emission standards will improve water quality by lowering the amount of emissions discharged into water during operation. These standards will alleviate the need for restrictions or bans on activity for some waterways as emissions from the marine engine fleet improves with the implementation of the regulation. However, waiting for fleet turnover to improve water quality may not be adequate for some waterways. For particularly sensitive waterways, a program which would restrict recreational activity to engines meeting ARB's corporate average standards may be a desired solution. In order to develop an effective program allowing only clean engines access to specific waterways, a mechanism for simple, enforceable and effective identification of clean engines is needed. For this reason, ARB is proposing the establishment of a model clean engine label, coupled to ARB's emission standards.

#### **C. Emission Performance Consumer Notification**

**Proposal.** The emission performance consumer notification requirements are based on the Small Off-Road Engines (SORE) regulation. Information available to consumers at the time of purchase, in the form of a standardized, removable label on the watercraft, will indicate the relative emissions performance of the engine. The Smog Index is calculated on a scale of 0 to 340 with a value of 100 indicating performance equal to the corporate average emission standard and 340 indicating performance at the upper limit of the averaging program.

**Intent.** Providing consumers with information about the emission performance of engines on the market may encourage the purchase and awareness of cleaner watercraft, further improving the effectiveness of the emission standards. Since watercraft are typically used in natural environments, consumers may have particular interest in minimizing the impact their new watercraft will have on the environment. Emission performance information may assist manufacturers trying to promote clean engine technologies by providing a standard measurement across the market for comparison.

#### **D. In-Use Compliance Testing and Recall**

**Proposal.** In-use testing and recall may be required of manufacturers in one of two ways. They may be required to submit results of the U.S. EPA In-Use Testing program to California. The U.S. EPA test results will be used to determine compliance of engines with California standards and may trigger recall requirements if the engines are identified as noncompliant. Given the relatively small volume of engines sold in California by individual manufacturers, a California specific program modeled after the U.S. EPA program would be cost prohibitive for

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manufacturers and would capture a very small number of engines on which to base recall actions. The second way that manufacturers may be subject to in-use testing and recall is through testing performed by the ARB or by ARB's contractor at the manufacturer's expense.

**Intent.** Because ARB's exhaust emission standards are in-use standards, a program to verify compliance with the standard is required. As discussed above, a California specific program, conducted by manufacturers, similar to the U.S. EPA program is probably cost prohibitive given the relatively small numbers of engines sold in California. However, use of U.S. EPA's existing provisions for California's standards will provide ARB with the necessary information to verify compliance. In-use testing and recall provisions provide ARB with assurance that California's exhaust emission standards are being met by manufacturers throughout the useful life of marine engines. By not establishing a California specific, manufacturer-conducted in-use test program, ARB will need further means of ensuring exhaust emission standards compliance. To accomplish this, ARB has proposed the warranty requirements, as discussed below.

#### **E. Emission Control Defects Warranty Requirements and Emission Control Warranty Statement**

**Proposal.** Currently, most manufacturers provide standard warranties of one year. Staff's proposed emission control defects warranty would provide a coverage period of 6 years or 350 hours for outboard engines, and 5 years or 350 hours for personal watercraft engines, whichever occurs first. Staff feels that these warranty periods are appropriate given the cost, useful life, and duty cycle of the engines. The addition of an hourly period ensures that marine engines that encounter very heavy usage (e.g., commercial applications) do not exceed their design life prior to the yearly warranty period. Determination of hourly use and warranty coverage thereof will require manufacturers to use hour meters.

For each new marine engine sold in California, engine manufacturers would be required to include an explanation of their emission control defect warranty, the warranty responsibilities of the owner, and provide proper maintenance instructions in the owner's manual. The emission control warranty statement required by the regulation is consistent with statements required by other ARB emission control programs.

**Intent.** Staff is proposing that engine manufacturers ensure that the engines they build will have emission-related components that are reliable, durable and capable of complying with the applicable emission standards. However, since subjecting each component to separate durability tests is costly and time-consuming, it is believed that an adequate defects warranty would act as an incentive for both engine manufacturers and parts suppliers alike to produce an overall, high-quality product.

## **F. Compliance and Production-Line Testing**

**Proposal.** The production-line testing program will follow a procedure similar to the U.S. EPA's Cumulative Sum procedure. This procedure replicates the statistical foundation of a federal compliance program known as a "Selective Enforcement Audit," and provides greater opportunity for a quick decision. The Cumulative Sum procedure reduces the manufacturer's testing burden, especially for those engine families whose test results are consistently below the emission standard by a wide margin. The minimum number of tests required is only two and the maximum is thirty.

The existing federal Cumulative Sum procedure is proposed to be modified to ensure year-round sampling; this will provide some assurance that engines meeting the standard in the first or second quarters of production do not encounter compliance problems in later quarters. Additionally, the use of family emission limits (FELs) and emission credits will not be applicable.

The staff are not proposing to include the U.S. EPA's Selective Enforcement Auditing program at this time, but rather will implement a compliance test program which is similar to that used in the small off-road engines program.

**Intent.** Staff proposes that compliance and production-line testing be included in the final marine engine rule as another enforcement program that ensures that manufacturers are building their engines as designed.

## **IV. Summary**

Gasoline SI marine engine emissions represent a significant impact to both air and water quality in California. The proposed regulations will significantly improve both air and water quality by establishing technically feasible emission standards and regulatory provisions for new engines sold in California.

Finally, this document is not intended to be an initial statement of reasons, but rather a summary of the preliminary draft proposed regulation. This summary and the draft proposal will be made available prior to the workshop scheduled for July 9, 1998. Staff invites constructive comments on the draft proposal at that time which will be incorporated into the regulation and the initial statement of reasons. Interested parties are invited to attend the public workshop and to contact staff if they have questions or comments regarding the proposal.